# Quantification of Mitral Regurgitation: Questions

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# DISCLOSURE

**Relevant Financial Relationship(s)**
None

**Off Label Usage**
None

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# Question 1

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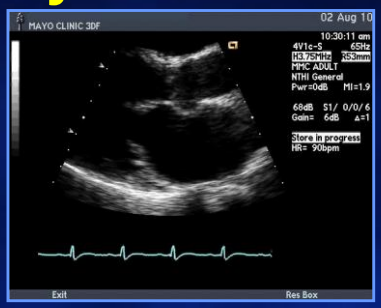
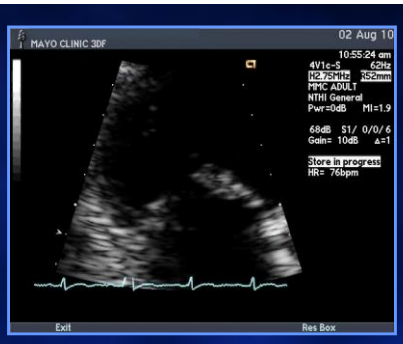
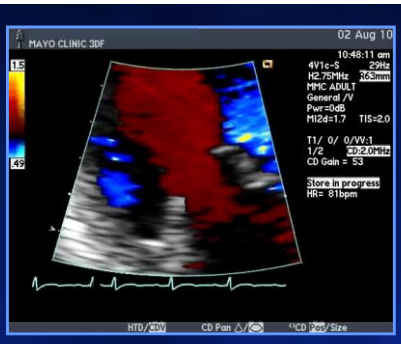
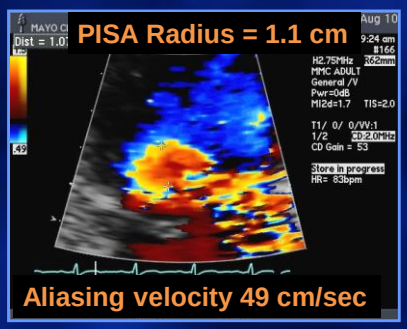
# 41 y/o woman: Dyspnea on exertion

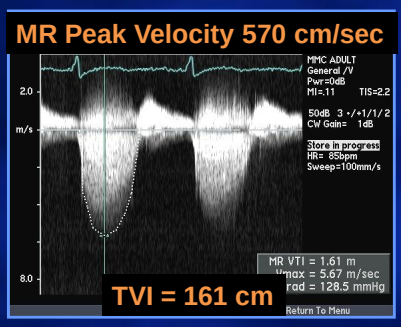





# What is the calculated ERO?

A. 0.45 $cm^2$
B. 0.55 $cm^2$
C. 0.35 $cm^2$
D. 0.65 $cm^2$
E. 0.75 $cm^2$

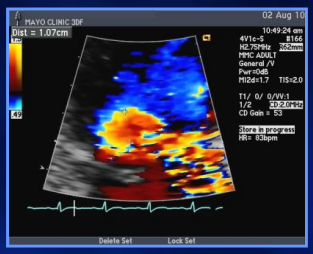
**PISA Radius = 1.1 cm**

**Aliasing velocity 49 cm/sec**

**MR Peak Velocity 570 cm/sec**

**TVI = 161 cm**

## Step 1: Calculate proximal MR flow



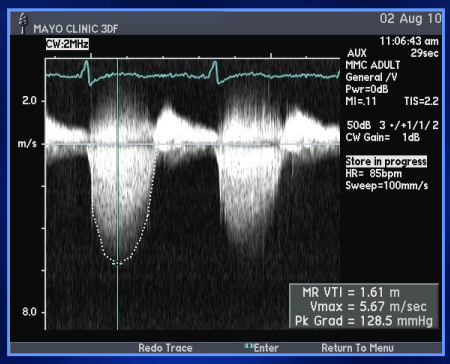

$$Flow_{MR} = Area_{PISA} \times Velocity_{Alias}$$

$$= 2\pi \times R^2 \times V_{Alias}$$

$$= 6.28 \times (1.1cm)^2 \times 49\ cm/sec$$

$$Flow_{MR} = 372\ cm^3/sec$$

## Step 2: Calculate the mitral ERO




$$ERO = \frac{Flow_{MR}}{Velocity_{MR}}$$

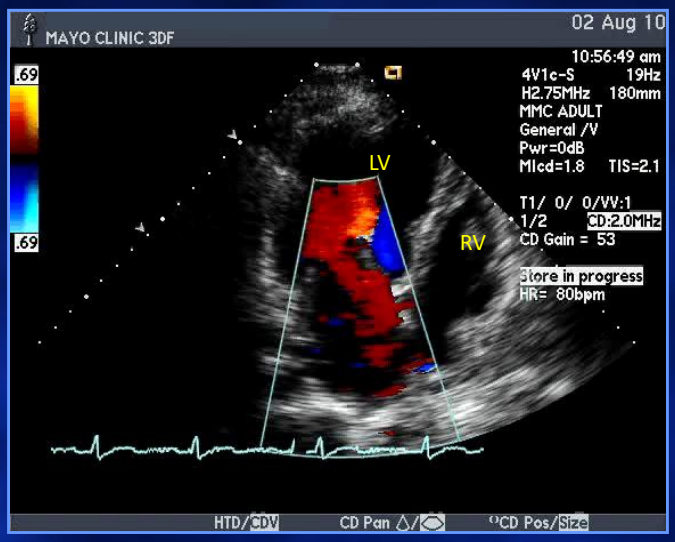
$$= \frac{372\ cm^3/sec}{570\ cm/sec}$$

$$Velocity_{MR} = 570\ cm/sec$$

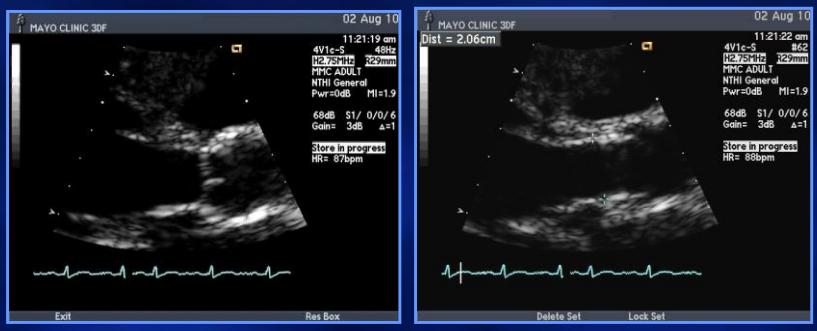
$$= 0.65\ cm^2$$

# Question 2

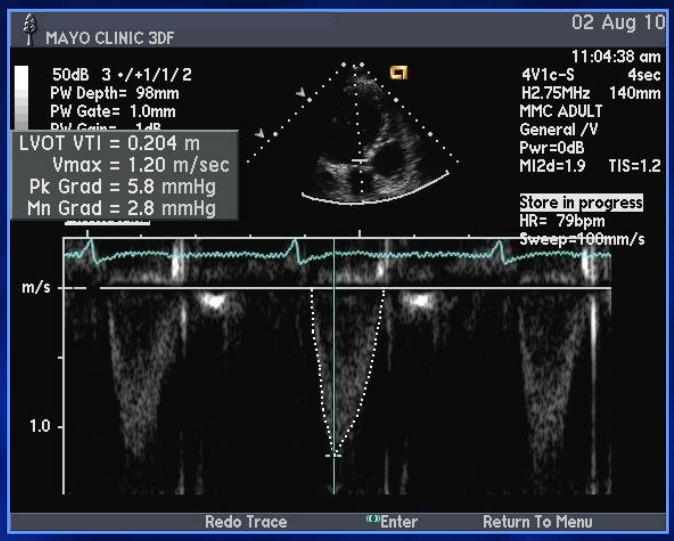
# 44 year old female with dyspnea



# LVOT 2.1 cm
# (no aortic regurgitation)



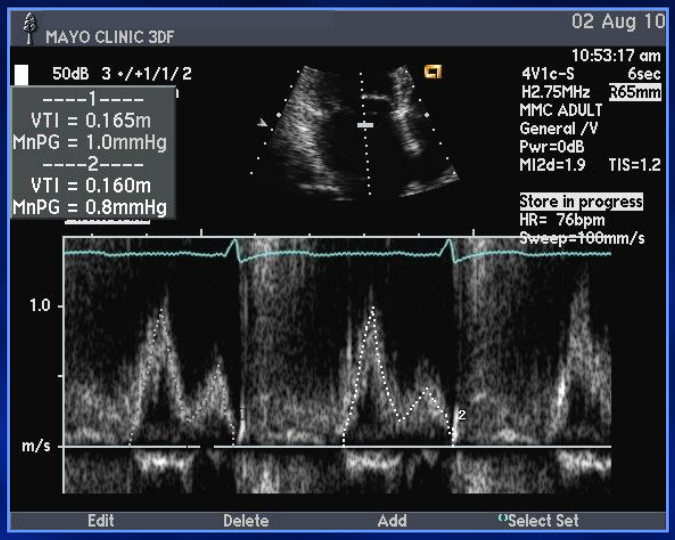

# LVOT TVI = 20 cm



# MV Annulus = 3.9 cm



# MV Annulus TVI = 16 cm



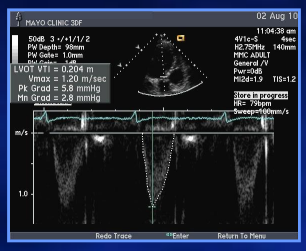
# What is Mitral Regurgitant Fraction?

A. 54%
B. 64%
C. 74%
D. 44%

- LVOT 2.1 cm
- LVOT TVI 20 cm
- MV Annulus Diameter 3.9 cm
- MV Annulus TVI 16 cm

# Step 1: Calculate LVOT Stroke Volume


LVOT Diameter = 2.1 cm



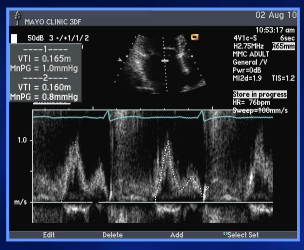

LVOT TVI = 20 cm

LVOT Stroke Volume = $0.785\ (2.1\ cm)^2$ x 20 cm

= $69\ cm^3$

# Step 2: Calculate MV Stroke Volume

MV Annulus = 3.9 cm



MV Annulus TVI = 16 cm

MV Stroke Volume = 0.785 $(3.9\ cm)^2$ x 16 cm

= 191 $cm^3$

# Step 3: Calculate MR Volume

MV Stroke Volume - LVOT Stroke Volume = MR Volume

191 $cm^3$ - 69 $cm^3$ = 122 $cm^3$

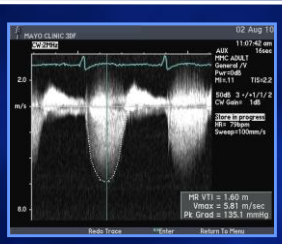
## Step 4: Calculate Regurgitant Fraction (RF)

$$\text{Mitral RF} = \frac{\text{MR Volume}}{\text{MV Stroke Volume}} = \frac{122\ cm^3}{191\ cm^3} = 64\%$$

## Step 5: Calculate MR ERO

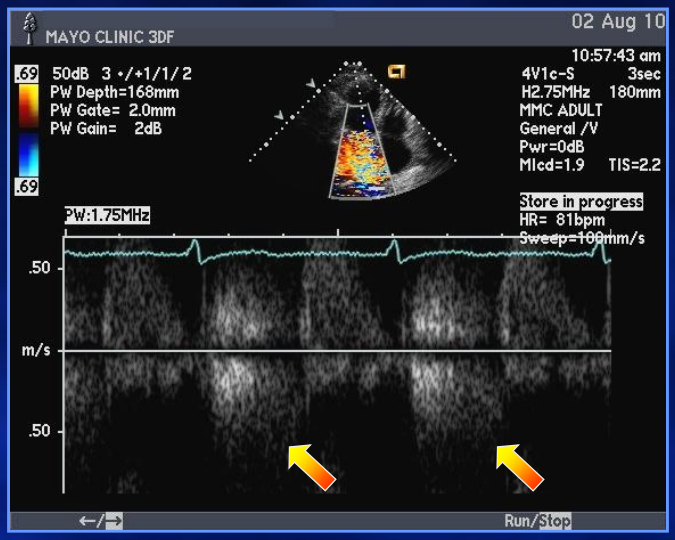
E ffective
R egurgitant
O rifice

$$= \frac{\text{MR Volume } 122\ cm^3}{\text{MR TVI (161 cm)}}$$




$$\text{ERO} = \frac{122\ cm^3}{161\ cm} = 0.76\ cm^2$$

# Pulmonary Vein: Systolic Flow Reversal




# Question 3

- A 66-year-old patient presents with angina, but no symptoms of heart failure. He has a history of hypertension, smoking, type 2 diabetes mellitus, and hyperlipidemia.
- He has a strong family history of coronary artery disease.
- A stress echocardiogram is positive with evidence of cavity dilatation.
- He undergoes cardiac catheterization and left main coronary artery disease is found.
- His echocardiogram reveals an ejection fraction (EF) of 59% and evidence for degenerative (primary) mitral regurgitation.

**Which of the following mitral valve echocardiographic parameters should prompt repair of the mitral valve in the setting of concomitant coronary artery bypass grafting?**

A. Mitral valve ERO = 41 $mm^2$
B. MR vena contracta = 0.5 cm
C. MR regurgitant fraction = 43%
D. MR regurgitant volume = 48 cc

# Chronic *Primary* Mitral Regurgitation: Intervention

| Recommendations | COR | LOE |
|---|---|---|
| Concomitant MV repair or replacement is indicated in patients with chronic severe primary MR undergoing other cardiac surgery | I | B |

**2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease**
Nishimura RA et al. Circulation. 2014 Jun 10;129(23):e521-643

# Quantitation of Mitral Regurgitation

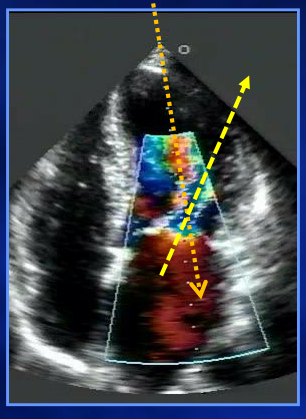
| | Mild | Moderate | | Severe |
|---|---|---|---|---|
| MR Volume ($cm^3$/beat) | <30 | 30 - 44 | 45 - 59 | ≥ 60 |
| Regurgitant Fraction (%) | <30 | 30 - 39 | 40 - 49 | ≥ 50 |
| ERO ($cm^2$) | <0.20 | 0.20-0.29 | 0.30-0.39 | ≥ 0.40 |
| Vena Contracta Width (cm) | < 0.3 | 0.3 - 0.69 | | ≥ 0.7 |

Zoghbi WA, et al. J Am Soc Echocardiogr 2017

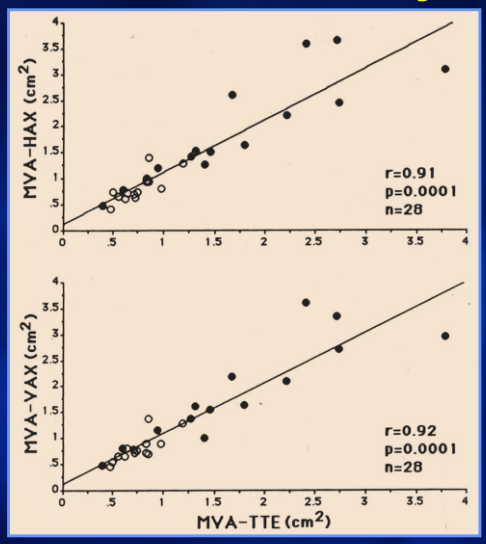
# Question 4

## 42 year old female with mitral stenosis. The Doppler angle of interrogation was sub-optimal

- What will this do to the pressure half-time (PHT)?
  - A. This will overestimate the MVA by PHT
  - B. This will underestimate the MVA by PHT
  - C. This will not effect the MVA calculation by PHT



# Doppler Angle of Incidence Does Not Influence MVA by PHT




Adapted from Stoddard MF, Prince CR, Tuman WL, Wagner SG. *Am Heart J* 1994. 27:1562

# Question 5

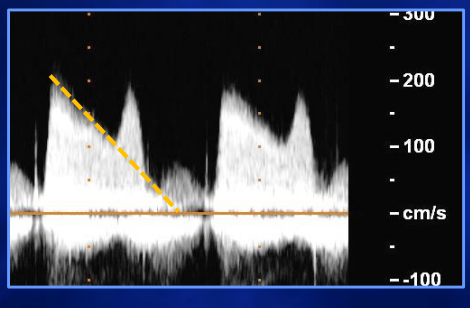
54 year old female with mitral stenosis

Mean mitral diastolic mitral gradient = 8 mmHg

Deceleration time = 420 ms

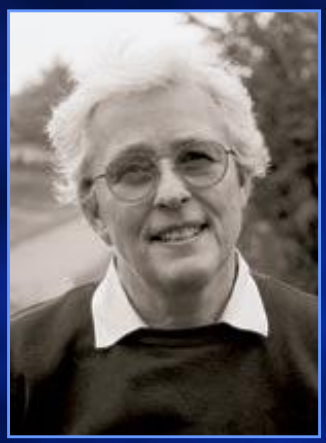
What is the mitral valve area?

A. 1.8 $cm^2$
B. 1.5 $cm^2$
C. 1.2 $cm^2$
D. 1.0 $cm^2$




## Doppler Pressure Half-Time

- **Hatle L et al. Noninvasive assessment of pressure drop in mitral stenosis by Doppler ultrasound. *Br Med J* 1978**
- **Concept first described by Libanoff and Rodbard in 1966**



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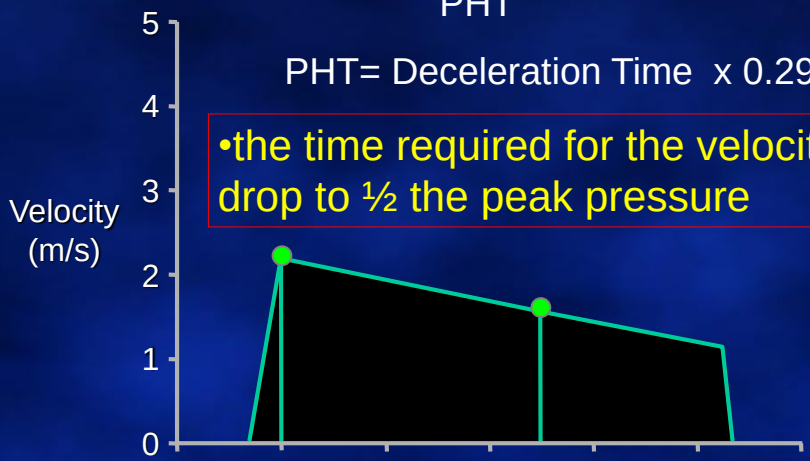
# Pressure Half-time

$$MVA = \frac{220}{PHT}$$

PHT= Deceleration Time x 0.29

- the time required for the velocity to drop to ½ the peak pressure

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# Mitral Valve Area Calculation

- PHT = DT x 0.29
  - 420 ms x 0.29 = 121.8 ms
- MVA = PHT/220
  - 220/121.8 = 1.8 $cm^2$

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# Thank You!

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